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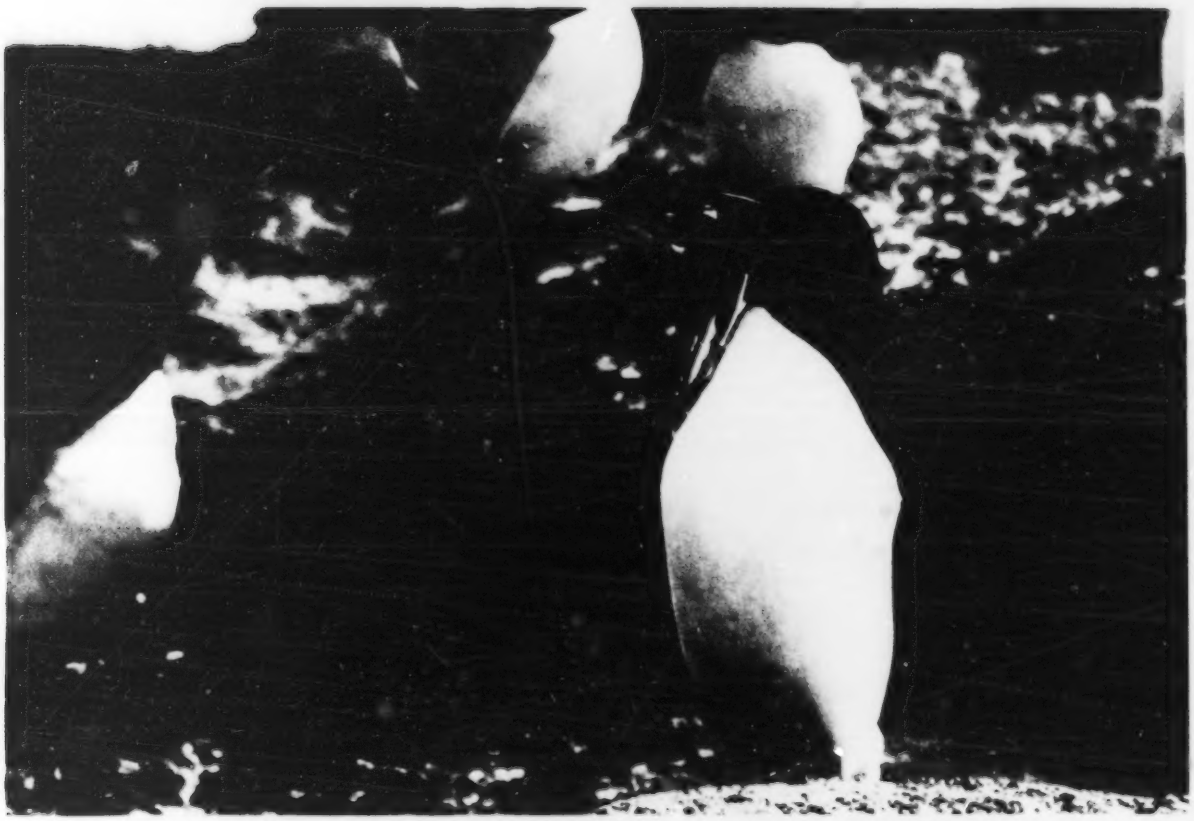
Status and population trends of the Razorbill in eastern North America

Occasional Paper
Number 105
Canadian Wildlife Service



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Abstract

Razorbill *Alca torda* is one of the rarest breeding auks in North America. A number of surveys have been conducted at breeding colonies in recent years to estimate population size and trends. Summarizing the available data, we estimate that approximately 38 000 pairs of Razorbills currently breed in eastern North America. The largest concentrations of Razorbills breed on the Quebec North Shore and in coastal southern Labrador; smaller numbers breed in the Quebec portion of the gulf and estuary of the St. Lawrence River, Maine, New Brunswick, Nova Scotia, Newfoundland, and St. Pierre and Miquelon. The single largest colony is on the Gannet Islands, Labrador, estimated at almost 10 000 breeding pairs. Most of the large breeding colonies have some legislated protection. Recent trends are encouraging, as populations on the Quebec North Shore and the Gannet Islands are increasing. However, a number of real and potential threats to the population still persist — namely, incidental take in the Newfoundland murre hunt, reductions in forage fish populations, gill-net mortality, and the risk of oiling. Surveys of colonies not visited in the last 20 years (Labrador and Newfoundland) and determining affinities between breeding colonies and a newly discovered wintering area in the Bay of Fundy remain priority areas of research that will help in the effective management of Razorbill populations.

Résumé

Le Petit Pingouin (*Alca torda*), qui niche en Amérique du Nord, figure parmi les plus rares espèces de la famille des alcidées. Des relevés ont été effectués récemment dans certaines colonies pour estimer les effectifs et déterminer les tendances des populations. D'après les données disponibles, nous avons évalué la population totale de Petits Pingouins qui nichent dans l'Est de l'Amérique du Nord à environ 38 000 couples. Les plus grandes concentrations de cette espèce se trouvent sur la Côte Nord du Québec et dans la partie sud de la côte du Labrador. Des colonies moins populeuses nichent dans la partie de l'estuaire et du golfe du Saint-Laurent appartenant au Québec, dans le Maine, au Nouveau-Brunswick, en Nouvelle-Écosse, à Terre-Neuve, et dans les îles St. Pierre et Miquelon. La plus grosse colonie est celle des îles Gannet, au Labrador, dont les effectifs sont estimés à presque 10 000 couples nicheurs. La plupart des colonies importantes bénéficient d'une protection prescrite par la loi. Étant donné que les populations de la Côte Nord du golfe du Saint-Laurent et des îles Gannet sont en hausse, il y a lieu d'être encouragé pour l'avenir de l'espèce. Toutefois, un certain nombre de menaces réelles et éventuelles persistent. Parmi celles-ci, mentionnons les prises accidentelles pendant la chasse au Guillemot de Brünnich à Terre-Neuve, la diminution des populations de poissons fourrages, les prises accidentelles des oiseaux de mer dans les engins de pêche et les risques de mazoutage. Des relevés de colonies qui n'ont pas été visitées depuis 20 ans (Labrador et Terre-Neuve) et la détermination des points communs entre les colonies nicheuses et un site d'hivernage récemment découvert dans la baie de Fundy sont des domaines prioritaires de recherche qui aideront dans la gestion efficace des populations de Petits Pingouins.

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We thank Roger Etcheberry for counts and information from St. Pierre and Miquelon, Dr. Jean Bédard (Société Duvetnor) for providing unpublished information on Razorbill breeding in the St. Lawrence estuary, and S. Kress and B. Allen for providing data for Maine. D.K. Cairns and N. Seymour made constructive comments that greatly improved earlier versions of the manuscript. We are very grateful to A.J. Gaston for constant support and constructive reviews of earlier drafts and to Michel Melançon, who prepared the figures.

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1. Introduction

The Razorbill *Alca torda* is one of the rarest breeding auks (Alcidae) in the North Atlantic, with an estimated global population of less than 1 million pairs. The majority of Razorbills breed in Iceland, where colonies support more than 450 000 pairs (Lloyd et al. 1991). About 145 000 pairs breed in the British Isles, mainly Scotland and Ireland (Lloyd et al. 1991), 30 000 pairs breed in Norway, and 8300 pairs breed in Sweden and Finland in the Baltic Sea (Nettleship and Evans 1985; Gaston and Jones 1998). Approximately 2000–5000 pairs are estimated to breed in west Greenland, where population size has not changed significantly during the past 50 years (Boertmann 1994; Boertmann et al. 1996).

The most recent reviews tentatively estimate the Canadian Razorbill population at 15 000–20 000 pairs (Nettleship and Evans 1985; Lock et al. 1994; Gaston and Jones 1998). The bulk of the Razorbill population in the northwest Atlantic is centred in southern Labrador and the lower Quebec North Shore of the Gulf of St. Lawrence (Bédard 1969; Fig. 1). Razorbill numbers had likely been greatly reduced by the early 1900s by unregulated hunting, disturbance, and egging (Nettleship and Evans 1985; Blanchard 1994). Because of concerns regarding the relatively small population breeding in North America, the large decline documented in the Gulf of St. Lawrence between 1970 and 1983 (Chapdelaine and Laporte 1982), apparent decreases at colonies in Labrador and Newfoundland compared with historical levels (Nettleship and Evans 1985), and their vulnerability to a number of sources of mortality, we reviewed the overall status of Razorbills breeding in eastern Canada, including small colonies in the United States and on St. Pierre and Miquelon (France).

2. Monitoring

As Razorbills are predominantly crevice nesters in North America, it is difficult to obtain accurate estimates of the size of the breeding population at many colonies (Cairns 1979). In addition, survey techniques that prove effective at one site may not work at other sites with different topographies. Ideally, direct nest counts should be made, but counts of birds at or near colonies continue to be used because of restrictions on time, because of the likelihood of disturbance, or because nests are hidden or inaccessible. A k-ratio ($k = N_p/N_i$) can be derived to convert counts of birds into estimates of breeding pairs, where N_p is the number of eggs or chicks at specific study plots and N_i is the number of adults present on the plots (Nettleship 1976; Birkhead and Nettleship 1980). Correction factors often differ within and among colonies owing to daily and seasonal variation in attendance patterns, which also vary among habitat types.

As examples, at the Sainte-Marie Islands in 1999, island-specific k-ratios were derived at the same time as counts were made of individuals rafting on the water in front of their respective nesting areas. The resulting k-ratios ranged from 0.23 to 2.35 ($n = 16$) in rock crevices and boulder scree habitats, and the mean k-ratio was 1.02. Because the k-ratios were not normally distributed (Shapiro-Wilk test), logarithmic transformation was used to remove the skewness in the data. Transforming back to the original scale, a derived mean of 0.82 was calculated, slightly smaller than the mean of the original counts before transformation. The 95% confidence interval (CI) of this k-ratio was 0.55–1.21. The breeding population estimate was 5363 pairs (0.82 × 6540 individuals counted), lying between 3597 (lower limit = 0.55 × 6540) and 7913 (upper limit = 1.21 × 6540). To this estimate we added 789 pairs, because eggs, rather than individuals, had been counted systematically for many subsections of the islands; therefore, a final estimate for the Sainte-Marie Islands was 6152 breeding pairs.

At the Gannet Islands, Labrador, k-ratios were also highly variable. For example, in 11 plots monitored in 1999, k-ratios ranged from 1.10 to 9.25, with a mean of 3.49. Logarithmic transformations effectively normalized the k-ratios, and k-ratios were further weighted by the number of eggs found in the plots. This weighting was done because the numbers of eggs counted on the plots were quite different (from 21 to 126 eggs counted), and we wished to increase the proportional contribution of plots where more eggs were counted to the calculation of the k-ratios. Using the

Figure 1
Distribution of Razorbill colonies in North America

logarithmically transformed data, the mean *k*-ratio for the Gannet Islands in 1999 was 2.903 (95% CI: 1.725–4.588); this resulted in a population estimate of 9808 breeding pairs, with relatively wide confidence limits (95% CI: 5830–15 505).

Correction factors are not available for many colonies, and survey results are usually given as total counts of individual adults. To convert from individuals to pairs at these colonies, we assumed that 1 bird = 1 pair (Table 1). It should be remembered that using this conversion factor introduces considerable but unquantifiable error into the estimate of the total Razorbill breeding population. As seen from the Sainte-Marie Islands and the Gannet Islands, *k*-ratios can be below 1.0 or well above 1.0, depending on the colony. Also, many population estimates are little more than very crude estimates. For all of these reasons, we recommend caution in using and interpreting Razorbill population size estimates.

Table 1
Estimated population (pairs) of Razorbills in eastern North America[a]

Location[b,c]		Estimated population (pairs)[d]	Method[e]	Year
Quebec (Canada)				
(1) Le Pilier de Bois	47°12'N 70°24'W	140	c	1995
(2) Île Brûlée	47°36'N 69°53'W	4	a	1990
(3) Le Long Pèlerin	47°43'N 69°45'W	1 141	b	1999
(4) Le Petit Pèlerin	47°42'N 69°45'W	1 807	b	1999
(5) Le Gros Pèlerin	47°45'N 69°42'W	641	b	1999
(6) Le Gros Pot	47°52'N 69°41'W	886	b	1999
(7) Le Petit Pot	47°52'N 69°41'W	220	b	1999
(8) Le Pot du Phare	47°52'N 69°41'W	2	b	1999
(9) Laval Island	48°45'N 69°02'W	4	c	1995
(10) De Quen Islets	50°07'N 66°26'W	2	c	1985
(11) Manowin Island	50°06'N 66°24'W	60	b	1985
(12) Corossol Island (MBS)	50°05'N 66°23'W	815	a, b	1998
(13) Île de la Maison	50°13'N 64°12'W	2	a	1983
(14) Île à Bouleaux du Large	50°13'N 64°00'W	2	c	1983
(15) Betchouane (MBS)	50°12'N 63°13'W	122	a	1999
(16) Watshishou (MBS)	50°16'N 62°30'W	6	a	1998
(17) Pashashibou (MBS)	50°15'N 62°20'W	4	c	1985
(18) Île à la Brume (MBS)	50°10'N 60°30'W	8	c	1999
(19) Unnamed Island (BIOMQ #562)	50°12'N 60°25'W	7	b	1995
(20) Unnamed Island (BIOMQ #563)	50°11'N 60°24'W	20	b	1995
(21) Rocher Grange	50°12'N 60°22'W	120	b	1995
(22) Rocher Cairntoor	50°11'N 60°22'W	20	b	1995
(23) Unnamed Island (BIOMQ #568)	50°12'N 60°12'W	250	b	1995
(24) Wolf Bay (MBS)	50°12'N 60°15'W	513	b	1999
(25) Unnamed Island (BIOMQ #572)	50°10'N 60°12'W	135	b	1995
(26) Unnamed Island (BIOMQ #567)	50°12'N 60°11'W	15	b	1995
(27) Unnamed Island (BIOMQ #566)	50°11'N 60°10'W	70	b	1995
(28) Unnamed Island (BIOMQ #571)	50°14'N 60°11'W	8	b	1995
(29) Unnamed Island (BIOMQ #575)	50°11'N 60°08'W	520	b	1995
(30) Unnamed Island (BIOMQ #555)	50°11'N 60°07'W	300	b	1995
(31) Île aux Œufs (Cape Whittle)	50°11'N 60°06'W	50	b	1995
(32) Unnamed Island (BIOMQ #556)	50°13'N 60°05'W	20	b	1995
(33) Îles de Ouapitagone du Large (BIOMQ #269)	50°11'N 60°04'W	12	b	1986
(34) Îles de Ouapitagone du Large (BIOMQ #559)	50°11'N 60°02'W	6	b	1995
(35) Îles de Ouapitagone du Large (BIOMQ #270)	50°13'N 60°02'W	5	b	1977
(36) Îles de Ouapitagone du Large (BIOMQ #271)	50°12'N 60°00'W	125	b	1995
(37) Unnamed Island (BIOMQ #272)	50°13'N 60°00'W	50	b	1995
(38) Unnamed Island (BIOMQ #274)	50°14'N 59°59'W	225	b	1995
(39) Unnamed Island (BIOMQ #273)	50°12'N 59°59'W	50	b	1995
(40) Unnamed Island (BIOMQ #276)	50°15'N 59°58'W	500	b	1995
(41) Unnamed Island (BIOMQ #275)	50°15'N 59°58'W	+	b	1986
(42) Unnamed Island (BIOMQ #277)	50°15'N 59°57'W	36	b	1995
(43) Récif Mistassini (BIOMQ #557)	50°13'N 59°57'W	26	b	1995
(44) Unnamed Island (BIOMQ #278)	50°15'N 59°56'W	100	b	1995
(45) Unnamed Island (BIOMQ #558)	50°16'N 59°56'W	4	b	1995
(46) Unnamed Island (BIOMQ #281)	50°15'N 59°54'W	140	b	1986
(47) Unnamed Island (BIOMQ #279)	50°15'N 59°55'W	58	b	1995
(48) Mariannes Islands	50°15'N 59°50'W	35	b	1986
(49) Galibois Islands (BIOMQ #576)	50°18'N 59°50'W	9	b	1995
(50) Galibois Islands (BIOMQ #283)	50°18'N 59°47'W	28	b	1995
(51) Boat Islands (MBS)	50°17'N 59°44'W	1 375	a, b	1999
(52) Sainte-Marie Islands (MBS)	50°18'N 59°40'W	6 152	a, b	1999
(53) Gros Mécatina (MBS)	50°45'N 58°45'W	366	b	1999
(54) St-Augustin (MBS)	51°08'N 58°28'W	2	c	1988
(55) Brador Bay (MBS)	51°28'N 57°17'W	1 300	d	1999
(56) Cap d'Espoir	48°25'N 64°19'W	2	c	1989
(57) Les Trois Soeurs (MBS)	48°32'N 64°13'W	6	c	1989
(58) Cap Blanc	48°30'N 64°13'W	2	c	1989

Continued

Table 1 (*cont'd*)
Estimated population (pairs) of Razorbills in eastern North America[a]

Location[b,c]		Estimated population (pairs)[d]	Method[e]	Year
(59) Bonaventure Island (MBS)	48°30'N 64°10'W	552	c	1989
(60) Percé Rock (MBS)	48°31'N 64°12'W	27	c	1989
(61) Forillon Peninsula	48°46'N 64°12'W	45	c	1989
(62) Joseph Point	49°24'N 62°08'W	24	c	1992
(63) Cape Tunnel	49°23'N 62°02'W	40	c	1992
(64) Innommée Bay	49°15'N 61°48'W	+	e	1992
(65) Falaise aux Goélands	49°09'N 61°42'W	25	b	1976
(66) Île d'Entrée	47°17'N 61°42'W	152	b	2000
(67) Brion Island (ER)	47°48'N 61°28'W	540	b	2000
(68) Bird Rocks (MBS)	47°51'N 61°09'W	942	b	2000
(69) L'Anse à la Cabane	47°13'N 62°00'W	12	b	2000
(70) Île aux Goélands	47°21'N 61°58'W	17	b	2000
Maine (United States)				
(71) Old Man	44°37'N 67°14'W	80	c	2000
(72) Freeman Rock	44°27'N 67°32'W	50	c	2000
(73) Pulpit Rock	44°33'N 67°28'W	10	c	2000
(74) Matinicus Seal Island	43°53'N 68°44'W	1	a	2000
(75) Matinicus Rock Island	43°47'N 68°51'W	136	a	2000
New Brunswick (Canada)				
(76) South Wolf Island	44°58'N 66°55'W	2	a	1995
(77) Yellow Murre Ledge	44°31'N 66°52'W	150	c	1999
(78) Machias Seal Island (MBS)	44°30'N 67°06'W	543	a	2000
Nova Scotia (Canada)				
(79) Pearl Island	44°23'N 64°03'W	1	c	1976
(80) Margaree Island	46°21'N 61°16'W	1	c	1990
(81) Bird Islands (Hertford Island)	46°22'N 60°23'W	186	c	1992
(82) Bird Islands (Ciboux Island)	46°23'N 60°22'W	30	c	1980
St. Pierre and Miquelon (France)				
(83) Cailloux Rouges	46°47'N 56°13'W	15	c	2000
(84) Côte ouest de Langlade	46°48'N 56°21'W	25	c	2000
(85) Grand Colombier	46°49'N 56°09'W	125	c	2000
(86) Cap Miquelon	47°08'N 56°21'W	4	c	2000
Newfoundland (Canada)				
(87) Île Brunette	47°15'N 55°55'W	50	c	1994
(88) Cape Pine Head	46°38'N 53°31'W	150	c	1985
(89) Western Head	46°39'N 53°38'W	7	c	1985
(90) The Drook	46°39'N 53°14'W	5	c	1985
(91) Cape St. Mary's (SER)	46°50'N 54°12'W	100	c	1979
(92) Great Island, Witless Bay (SER)	47°11'N 52°49'W	100	c	1979
(93) Green Island, Witless Bay (SER)	47°15'N 52°47'W	170	c	1979
(94) Gull Island, Witless Bay (SER)	47°16'N 52°46'W	261	c	2000
(95) Baccalieu Island	48°07'N 52°48'W	100	c	1984
(96) Cabot Island, South	49°10'N 53°22'W	25	a	1985
(97) Woody Island	49°33'N 55°18'W	+	e	1973
(98) Coleman Island	49°33'N 53°49'W	10	c	1984
(99) Small Island, Wadham Island	49°35'N 53°47'W	20	a	1984
(100) Funk Island (SER)	49°45'N 53°11'W	200	c	1980
(101) Storehouse Islets	49°25'N 54°25'W	+	e	1984
(102) Gull Island, Cape St. John	50°00'N 55°22'W	25	e	1943
(103) Tin Pot Islands	50°03'N 56°05'W	25	e	1943
(104) Groais Island	50°59'N 55°38'W	+	e	1943
(105) The Sisters Rock	50°59'N 55°32'W	25	e	1943
Labrador (Canada)				
(106) Halfway Island	53°42'N 56°11'W	+	e	1978
(107) Bird Island	53°44'N 56°15'W	1 530	b	1978
(108) Gannet Islands (SER)	53°56'N 56°32'W	9 808	b	1999
(109) Outer Gannet Island (SER)	54°00'N 56°32'W	388	b	1998
(110) Herring Islands	54°20'N 57°06'W	1 250	b	1978
(111) North Green Island	54°24'N 57°19'W	380	b	1978

Continued

Table 1 (*cont'd*)
Estimated population (pairs) of Razorbills in eastern North America[a]

Location[b,c]		Estimated population (pairs)[d]	Method[e]	Year
(112) North Duck Island	54°25'N 57°10'W	+	e	1978
(113) Tinker Island	54°25'N 57°16'W	11	b	1978
(114) Puffin Island	54°25'N 57°23'W	70	b	1978
(115) Unidentified Island east of Pompey Island	54°26'N 57°07'W	50	b	1978
(116) East Big Island	54°27'N 57°06'W	+	e	1978
(117) Bacalhao Island	54°27'N 57°10'W	+	e	1978
(118) Tinker Island	54°42'N 57°26'W	3	b	1978
(119) Unidentified Island northeast of Red Rock Point	54°43'N 57°42'W	+	e	1978
(120) Unidentified Island north of Red Rock Point	54°43'N 57°45'W	+	e	1978
(121) Quakers Hat	54°44'N 57°20'W	450	b	1978
(122) Unidentified Island south of Maggo Island	55°32'N 60°02'W	+	e	1978
(123) Katauyak Island	55°54'N 60°34'W	65	b	1978
(124) Nunaksuk Island	56°03'N 60°28'W	190	b	1978
(125) Kidlit Islands	56°13'N 60°28'W	200	b	1978
(126) Ukallik Island	56°14'N 60°36'W	120	b	1978
(127) Negro Islands	56°21'N 60°33'W	+	e	1978
(128) The Castle	56°21'N 60°40'W	+	e	1978
(129) Pyramid Islands	56°26'N 60°32'W	+	e	1978
(130) Unidentified Island west of the Lost Islands	56°26'N 60°48'W	12	b	1978
Nunavut (Canada)				
(131) Digges Sound	62°33'N 77°43'W	6	b	1981
(132) Loks Land	62°21'N 64°45'W	50	e	1953

[a] Data for Canada are from the Banque Informatisée des Oiseaux Marins du Québec (BIOMQ) and Atlantic Canada Seabird Colony Database. R. Etcheberry provided data for St. Pierre and Miquelon (France), and S. Kress and B. Allen provided data for Maine (United States).
[b] See corresponding number on Figs. 1, 2, 3, 4, and 6.
[c] MBS = Migratory Bird Sanctuary; ER = Ecological Reserve under Quebec provincial legislation; SER = Seabird Ecological Reserve under Newfoundland and Labrador provincial legislation.
[d] + = birds present in low number but no estimate.
[e] a = counts of eggs or occupied sites; b = counts of birds corrected by *k*-factor; c = uncorrected counts of birds but assuming 1 bird = 1 pair; d = density of eggs extrapolated to uniform breeding habitat occupied by birds; e = unknown.

3. Population size and trends

All the data for Canadian colonies presented in this section are available in two databases: the Atlantic Canada Seabird Colony Database, maintained by the Canadian Wildlife Service, Atlantic Region, Sackville, New Brunswick, and the Banque Informatisée des Oiseaux Marins du Québec (BIOMQ), held by the Canadian Wildlife Service, Quebec Region, Ste-Foy, Quebec. These two databases provide a source of reference for current and past estimates of seabird numbers in eastern Canada. Additional references and the original source of many of the older data include Brown et al. (1975), Cairns et al. (1989), and Lock et al. (1994), and we recommend consulting these sources for further information. This is particularly important for anyone wishing to use the data in specialized studies or for those who want to make comparisons with more recent surveys. Data for Maine were provided by S. Kress and B. Allen, whereas data from St. Pierre and Miquelon were provided by R. Etcheberry.

Our current estimate of the number of breeding pairs of Razorbills in eastern North America totals approximately 38 000 pairs (Tables 1 and 2).

The Gulf of St. Lawrence and St. Lawrence River estuary support a number of large colonies (Table 2; Figs. 2, 3, and 4). Approximately 21 000 pairs of Razorbills are estimated to breed in Quebec. In the Gulf of St. Lawrence, the largest Razorbill breeding colony is in the Sainte-Marie Islands Migratory Bird Sanctuary, where 6152 pairs were estimated to breed in 1999. This sanctuary is a group of six islands where Common Murres *Uria aalge*, Atlantic Puffins *Fratercula arctica*, and Black Guillemots *Cepphus grylle* also breed. The Boat Islands (1375 pairs), Brador Bay (1300 pairs), and Bird Rocks (942 pairs) are also major breeding sites elsewhere in the Gulf. In the St. Lawrence estuary, breeding Razorbills are concentrated on a group of islands north of Rivière-du-Loup. The three largest colonies are on Le Petit Pèlerin (1807 pairs), Le Long Pèlerin (1141 pairs), and Le Gros Pot (886 pairs). Our best indices of population change in Quebec come from the counts of individual Razorbills at colonies in Migratory Bird Sanctuaries on the North Shore of the Gulf of St. Lawrence, undertaken every five years from 1925 to the present (Chapdelaine 1995; J.-F. Rail and G. Chapdelaine, unpubl. data). Between 1925 and 1965, the population in the sanctuaries hovered around 10 000 individuals, rising to above 18 000 in 1955. After 1965, substantial decreases were recorded in the sanctuaries (Chapdelaine and Laporte 1982); however, increases have been observed since 1989, and counts of birds reached a maximum of 15 000 individuals in 1998–99 surveys (Fig. 5). In the estuary, historical data are insufficient to assess trends, but recent counts suggest an increase over the last 10 years (J. Bédard, pers. commun.).

Table 2
Summary of Razorbill population estimates for North America by geographic region

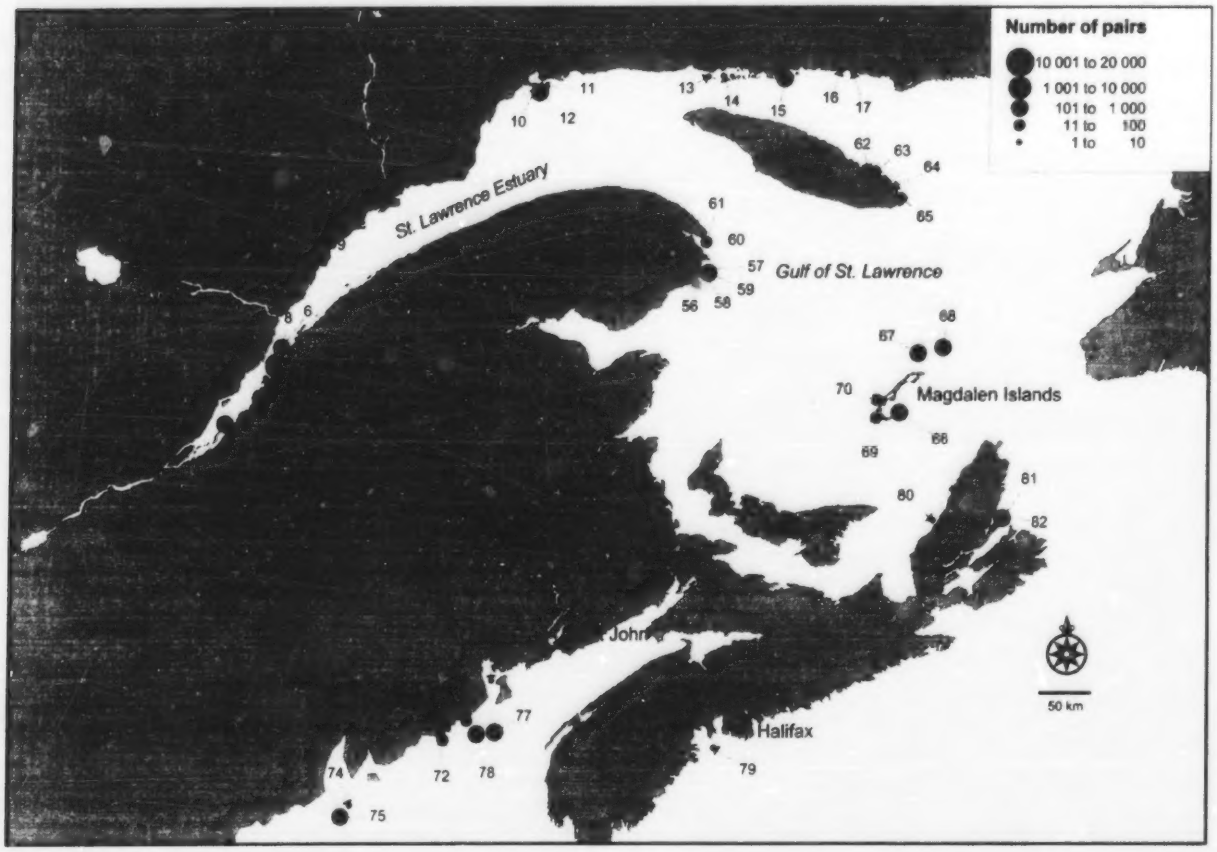
Region	Population (breeding pairs)
Eastern Arctic	56
Labrador	14 527
Eastern Newfoundland	1 273
Islands of St. Pierre and Miquelon (France)	169
St. Lawrence estuary (Quebec)	4 845
Gulf of St. Lawrence (Quebec)	16 059
Scotian Shelf – Bay of Fundy – Gulf of Maine (New Brunswick, Nova Scotia, and Maine)	1 190
Total	38 119

Nova Scotia, New Brunswick, and Maine have relatively few breeding Razorbills (Fig. 2), with approximately 220, 700, and 280 breeding pairs, respectively. Razorbills do not currently breed in Prince Edward Island. A first nesting record in the Wolves Archipelago, New Brunswick, in 1995 (Mawhinney and Sears 1996) and increasing numbers observed at Machias Seal Island between 1994 and 1998 (A.W. Diamond, unpubl. data) suggest an upward trend in the Bay of Fundy.

Although Newfoundland has the largest number of seabird populations in eastern North America, Razorbills are not common (Table 2; Fig. 4). Available surveys indicate that almost 1300 pairs breed around the island of Newfoundland. We consider this to be an underestimate, as no estimates are available for several colonies where Razorbills are known to breed, most available estimates are at least 15 years old, and counts on Gull Island, Witless Bay, have been increasing for the last 20 years (from 50 pairs in 1979 to 261 pairs in 2000).

St. Pierre and Miquelon (France) have four small Razorbill colonies, accounting for approximately 170 pairs. Counts since 1990 suggest that these colonies may be increasing in size (R. Etcheberry, pers. obs.).

Figure 2
Location of Razorbill colonies in Quebec (in part), New Brunswick, Nova Scotia, and Maine



Along with Quebec, Labrador harbours significant populations of breeding Razorbills (Table 2; Fig. 6). The Gannet Islands support the largest breeding population in North America, estimated at close to 10 000 pairs in 1999. Other major breeding colonies in this area are Bird Island and the Herring Islands, with estimates from 1978 of 1530 and 1250 pairs, respectively. Overall, based on our most recent estimates, around 15 000 pairs of Razorbills breed in Labrador. As with colonies around the island of Newfoundland, the current population size outside the Gannet Islands is probably underestimated, as all other colonies were last surveyed in 1978. Evidence from the Gannet Islands suggests that the population of Razorbills increased by about 50% between 1978 and 1999 (Fig. 7).

Two colonies are known in Nunavut, but they are very small. The Loks Land colony of 50 pairs has been known since 1953 (Brown et al. 1975), but no attempt has been made to repeat this census. Finally, a few pairs of Razorbills breed in the Digges Sound, off the northwestern tip of Quebec (Gaston et al. 1985). Periodic sightings elsewhere in Hudson Strait suggest that scattered pairs may breed elsewhere in that area (A.J. Gaston, pers. commun.).

Figure 3
Location of Razorbill colonies on the Quebec North Shore (in part)

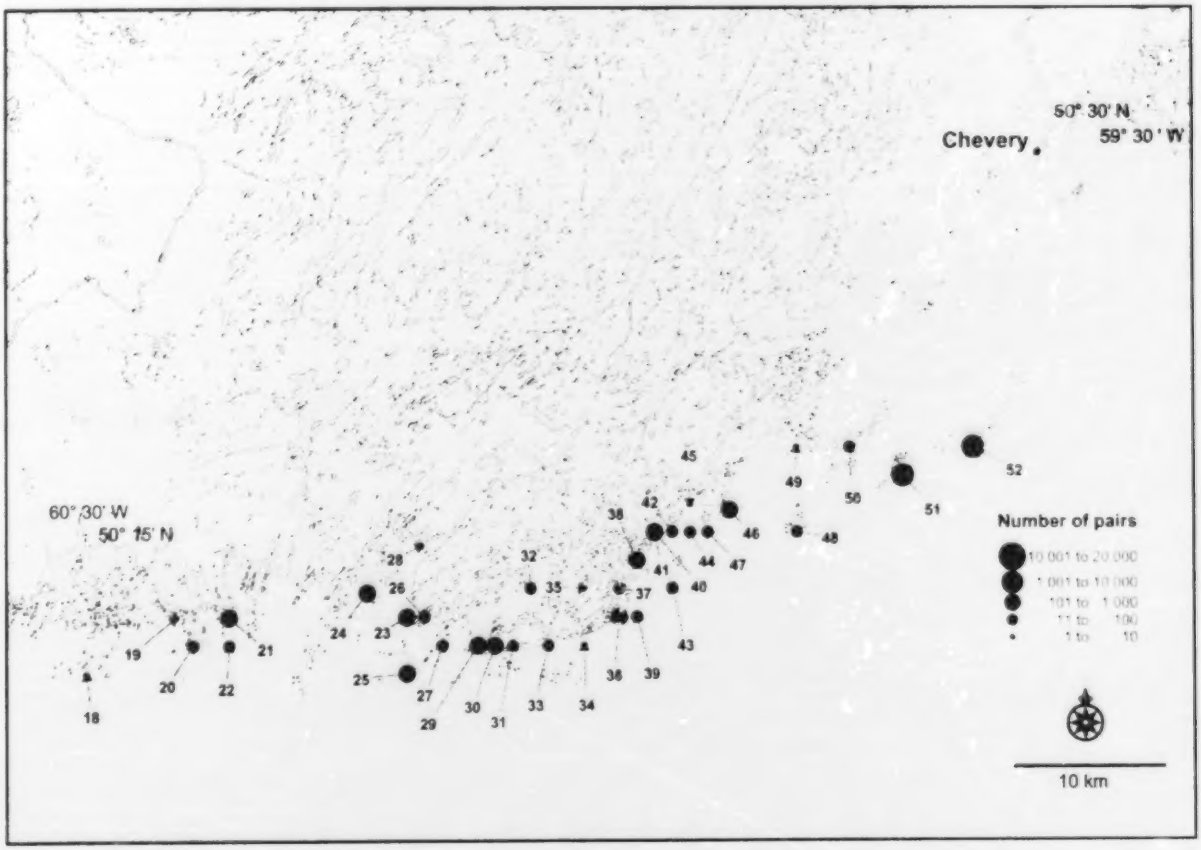


Figure 4
Location of Razorbill colonies in Newfoundland, Quebec (in part), and St. Pierre and Miquelon (France)

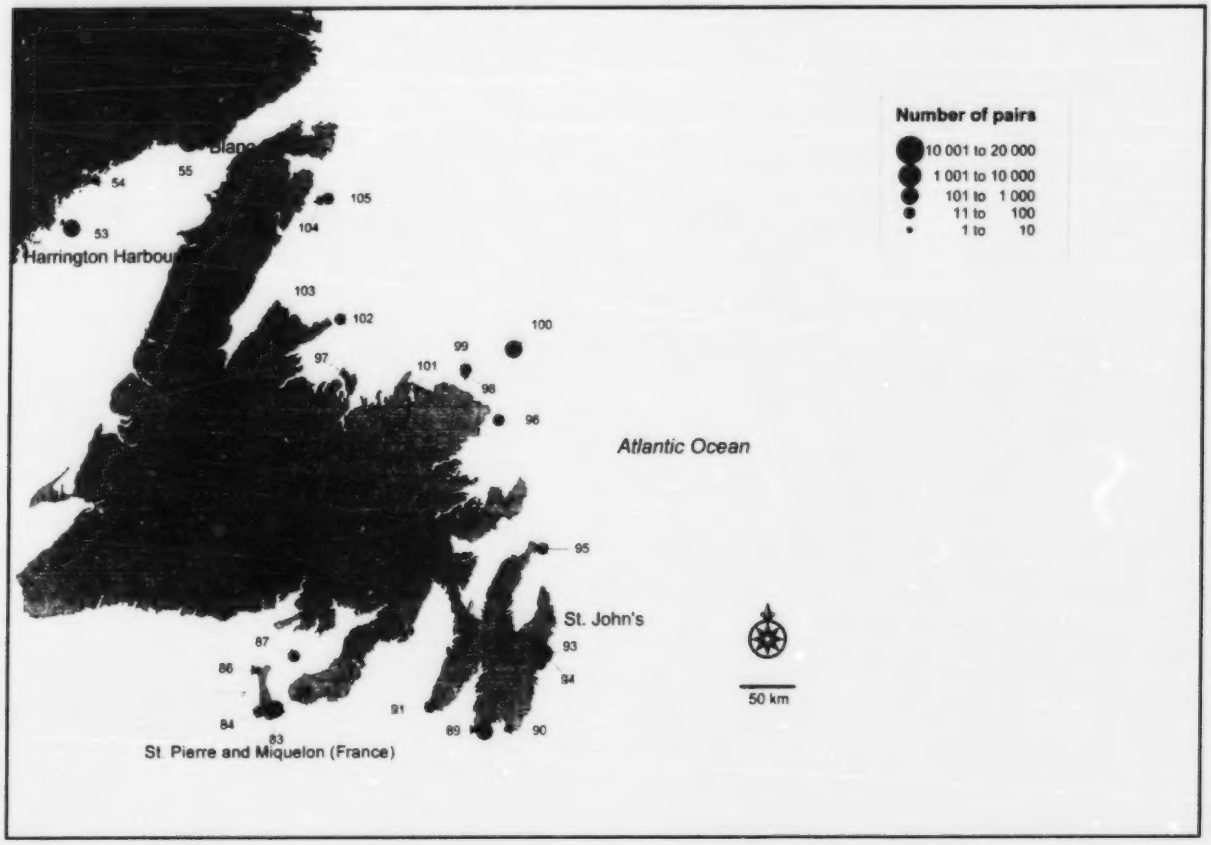


Figure 5
Trends in counts of Razorbills in the nine Migratory Bird Sanctuaries of the Quebec North Shore, 1925–99

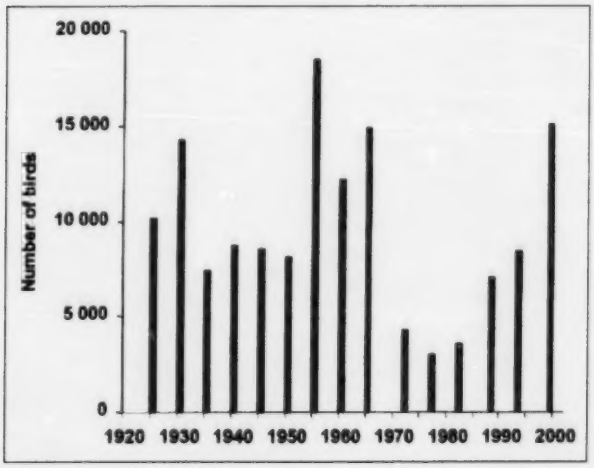


Figure 6
Location of Razorbill colonies in Labrador

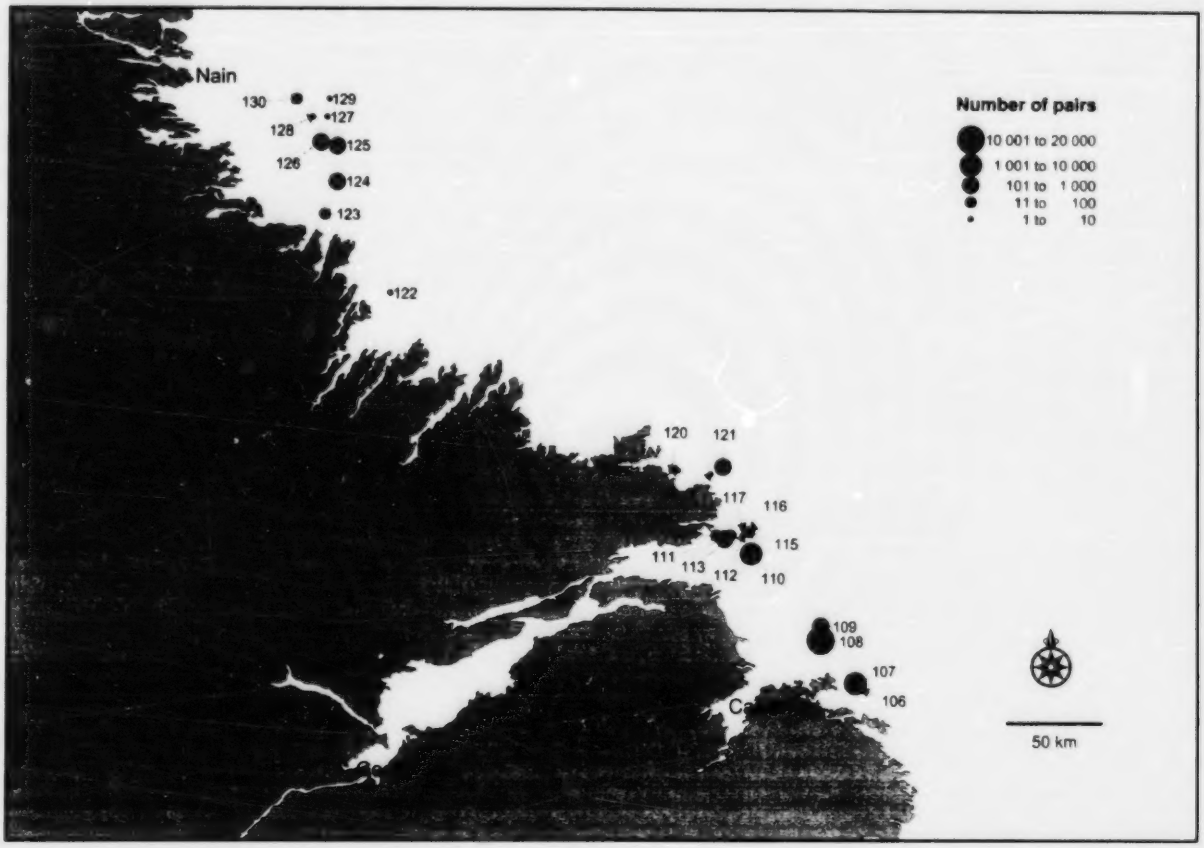
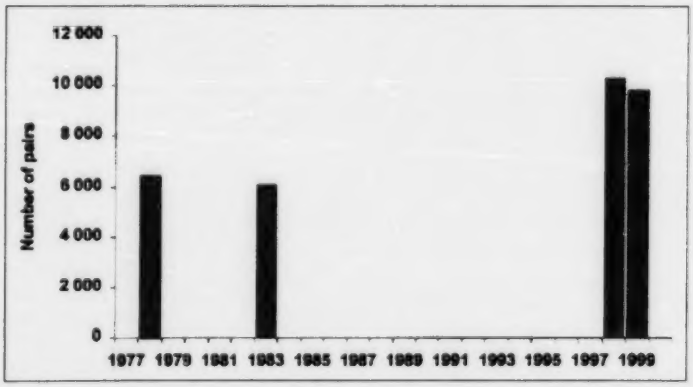


Figure 7
Changes in the estimated number of pairs of Razorbills breeding on the Gannet Islands (excluding Outer Gannet Island), 1978–99



4. Protection

All seabirds, except cormorants, are protected year-round under the *Migratory Birds Convention Act* in Canada and the United States. Razorbills are classified as a nongame species, so there is no open hunting season (incidental take, however, does occur; see next section). In St. Pierre and Miquelon, there is also no open hunting season for Razorbills.

Most major seabird colonies in eastern Canada have some protected status. Many important Razorbill colonies are designated as federal Migratory Bird Sanctuaries and protected under the *Migratory Birds Convention Act* in the Gulf of St. Lawrence. These include Bird Rocks, Bonaventure Island, Betchouane, Corossol Island, Sainte-Marie Islands, Wolf Bay, Boat Islands, Gros Mécatina, and Brador Bay in the Gulf of St. Lawrence and Machias Seal Island in the Bay of Fundy. Access to these colonies is allowed only under permit. In Newfoundland and Labrador, most seabird colonies are protected as Seabird Ecological Reserves under provincial legislation, the *Wildlife and Ecological Reserves Act*. The Gannet Islands, Outer Gannet Island, the Witless Bay Islands (Gull, Green, and Great islands), Cape St. Mary's, Funk Island, and Baccalieu Island are all protected under this legislation. Although there are slight differences in management and regulations among these colonies, access is generally allowed only under permit. Cape St. Mary's is an exception, as this mainland colony caters to tourists who come to see Northern Gannets *Morus bassanus* and the other seabirds. As the cliffs are so steep and high at this site, there is relatively little disturbance to nesting seabirds. Similarly, Machias Seal Island, New Brunswick, is protected as a Migratory Bird Sanctuary; tourists are strictly regulated while ashore and consequently cause very little disturbance to the seabirds.

5. Potential and known threats

Introductions or sporadic incursions of predators, even natural ones such as foxes, can have devastating and long-lasting effects on seabirds (Lloyd et al. 1991). During the 1990s, Arctic foxes *Alopex lagopus* that crossed the winter ice to the Gannet Islands had severe impacts, killing adult Razorbills and markedly reducing the number of birds attempting to nest (Birkhead and Nettleship 1995). They also apparently caused a redistribution of breeding Razorbills to islands without foxes (R. Elliot, pers. obs.). Similar observations were reported in Brador Bay in 1988 (Chapdelaine and Brousseau 1991). Sporadic invasions of Le Long Pèlerin, Le Petit Pèlerin, and Le Gros Pèlerin islands in the St. Lawrence estuary by red fox *Vulpes fulva* prevent the Razorbill from breeding successfully in some years (J. Bédard, pers. commun.).

Razorbills are shot, presumably in error, during the harvest of murres in Newfoundland and Labrador, the only nonnative legal hunt of seabirds in Canada and the United States. Although it is difficult to estimate the numbers killed, interviews with hunters (Elliot 1991) and analysis of band returns (Chapdelaine 1997) suggest that several hundred to a thousand Razorbills, primarily first-year birds, may be shot each year. Reductions in the length of the murre hunting season, beginning in 1993, were designed to reduce this impact. However, this incidental take of Razorbills is likely to continue because of the difficulty in distinguishing Razorbills from murres on the sea in typical fall or winter hunting conditions. It is also possible that a few Razorbills are taken incidentally in the legal hunt of murres, Dovekies *Alle alle*, and Black Guillemots on St. Pierre and Miquelon. Additionally, in Canada, aboriginal peoples are legally allowed to take auks, including Razorbills, for subsistence purposes. In areas of coastal Labrador, there may be a take of Razorbills and their eggs, but this harvest is likely small.

Fishing nets also provide a hazard to seabirds, as the birds become entangled in the nets and drown (Falk and Durinck 1991; Chardine 1998). The coastal gill-net fishery for Atlantic salmon *Salmo salar* on the Quebec North Shore apparently caused heavy mortality of Razorbills between 1975 and 1990 (G. Chapdelaine, pers. obs.). Although no consistent data exist to support this observation, it seems unlikely to be a coincidence that the Razorbill population started to recover after the Quebec provincial government closed this traditional fishing activity. Although there is a current moratorium on most groundfish fishing in Newfoundland and the Gulf of St. Lawrence, Razorbills are still

being caught in gear set for lumpfish (*Cyclopterus* spp.) and Atlantic cod *Gadus morhua* (I.L. Jones, pers. commun.).

Although currently not large-scale commercial ventures in Labrador and the Quebec North Shore, the possible development of fisheries targeting forage fish such as sandlance (*Ammodytes* spp.) and capelin *Mallotus villosus*, staples of the Razorbill's diet (Chapdelaine and Brousseau 1996), presents a threat to Razorbill. The almost complete breeding failure of Atlantic Puffin in the Lofoten Islands, Norway, between 1964 and 1980 was correlated with overfishing of their preferred prey (Lid 1981). Fisheries for sandlance caused serious declines in breeding success of seabirds in Britain (Furness and Ainley 1984; Monaghan 1992), and the Newfoundland capelin fishery apparently reduced the breeding success of Atlantic Puffins in Witless Bay in 1981 (Brown and Nettleship 1984).

The southeastern coasts of Newfoundland are severely affected by chronic oil pollution; although low in number in comparison with murres and Dovekies, oiled Razorbills do wash up on shore (Wiese and Ryan 1999). Accidental oil spills have killed a number of Razorbills along the U.S. Atlantic coast, and Razorbills represented 14% (n = 181) of birds found oiled following the wreck of the *Argo Merchant* offshore of Nantucket Island, Massachusetts, in December 1976 (Powers and Rumage 1978). The St. Lawrence estuary is the entrance to the most important seaway for maritime traffic in North America, and a spill during the breeding season could affect the large population of Razorbills breeding at Le Long Pèlerin, Le Petit Pèlerin, Le Gros Pèlerin, and Le Gros Pot. The large concentration of wintering Razorbills in the mouth of the Bay of Fundy, which has been identified only recently but which may host a large proportion of the total North American population during winter (Huettman 1999), is particularly vulnerable to a single large oil spill. This wintering area is adjacent to a major shipping lane used by oil tankers heading to Saint John, New Brunswick, and other ports in the Gulf of Maine.

6. Evaluation

Razorbills exhibit high annual survival rates, with estimates ranging between 89 and 92% (Hudson 1985; Harris and Wanless 1989; Chapdelaine 1997), a delayed maturity (approximately five years), and a low reproductive rate, which indicate a classical K-selected species. For those species, demographic models demonstrate that adult survival is very sensitive to population dynamics (Croxall and Rothery 1991; Danchin et al. 1995). Current population trends that suggest increases at many colonies are encouraging. However, Razorbill populations have declined in the past and may do so again, given their relatively small population size and the large number of potential threats to populations. With moratoria on many gill-net fisheries, little interest in forage fish fisheries, and the lack of a major oil spill in the recent past, current conditions for Razorbills in eastern North America are quite favourable. However, as any one of these sources of mortality can appear very quickly, with potentially serious impacts on the North American population, continued close monitoring of Razorbills in North America is certainly warranted.

7. Future research and management needs

This summary of the status of Razorbills in eastern North America represents a starting point to guide the management of Razorbill populations. However, there are still significant gaps in our understanding of this species. A number of colonies, especially in Newfoundland and Labrador, have not been surveyed in over 20 years. These population estimates need to be updated. By-catch, hunting mortality, oiling, and poor foraging conditions probably all have impacts on Razorbill populations. However, the importance and magnitude of these impacts are not well understood. Most major Razorbill breeding colonies are afforded some legislative protection; the same is not true for their migration routes and wintering areas. The large concentration of Razorbills wintering in the mouth of the Bay of Fundy needs to be better understood; whether this concentration is maintained throughout the winter or is a more ephemeral phenomenon needs to be determined. Finally, understanding the affinities between breeding and wintering populations will determine where stocks of breeding Razorbills spend the winter and will provide information on the potential threats they may encounter outside the breeding season.

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